A BIOGRAPHICAL SKETCH OF JOHN ADAM RYDER.

BY HARRISON ALLEN, M. D.

I.

JOHN ADAM RYDER,[1] the first child of his parents, was born February 29, 1852, near Loudon, Franklin County, Pennsylvania. His parents are Benjamin Longenecker Ryder and Anna Frick Ryder. On his father's side he was descended from Michael Ryder who was one of three sons whose father came from England and settled near Cape Cod, Massachusetts. Michael Ryder removed from Massachusetts to Pennsylvania where his descendents have since lived. His paternal grandmother, Elizabeth Longenecker, the wife of Adam Ryder, was of German origin. She was born in Lancaster County, Pennsylvania.

Anna Frick Ryder, the mother of John Ryder, was born in Maryland. She is in part of Swiss descent. The maternal grandmother Anna Kelso was of Scotch origin. Her great grandfather was William, Earl of Kelso. At the time of the persecution of the Presbyterians in Scotland during the reign of Charles II, the Earl of Kelso, together with his wife, infant son and brother James, were compelled to leave Scotland. They sought refuge in Ireland, where James Kelso was captured, taken to London and executed. The

[1] In the preparation of this sketch the list of questions prepared by Mr. Galton in his monograph on "Men of Science" was sent to the family of Dr. Ryder and the details in all respects are based upon the answers received. The expressions of opinion of the speakers at a meeting held at the Academy's Hall, April 10, 1895, have been frequently quoted. The words "Memorial Pamphlet," when following a quotation refers to a brochure entitled "In Memoriam," which comprises addresses delivered at that meeting in the following order: Dr. Harrison Allen, Dr. Bashford Dean, Prof. Horace Jayne, Prof. E. D. Cope, Mr. H. F. Moore and Prof. W. P. Wilson. The brochure was printed for private distribution by a few admirers of Dr. Ryder in the fall of 1895. The writer desires to express his acknowledgments to many of Dr. Ryder's associates for information, especially to Rev. Jesse Y. Burk, Secretary of Board of Trustees University of Pennsylvania, Mr. W. C. Seal of Philadelphia, Prof. J. S. Kingsley of Tuft's College, Massachusetts, Mr. Edward Brooks, Superintendent of the Public Schools of Pennsylvania, and Mr. Herbert A. Gill, Secretary of the United States Fish Commission.

estates were confiscated. A grandson of William Kelso, above referred to, came to America.

It will be thus seen that Dr. Ryder was twice removed from ancestors who combined English, Scotch, German and Swiss traits.

Dr. Ryder's father was by training a farmer. He became interested in horticulture and at one time conducted a large nursery. His talents for invention are of an exceptional order; he has improved mechanical devices for preserving and curing fruits, vegetable and animal products, and has become widely known in connection with their manufacture and introduction.

Dr. Ryder's inventive ability can be traced in great measure to his father and remotely to the Longenecker branch of the family. His mother, however, possesses inventive skill in no mean degree. Ryder had no taste for music; in this respect he resembled his mother, since the taste was well developed in the father. He had a natural facility for drawing, although he never cultivated it beyond what was necessary for the illustration of his papers and for the class room. This talent, also, is traceable to his father. His taste for natural history is a direct inheritance from his mother. While Dr. Ryder never became much interested in medicine, many phases of his researches are so closely allied to this science that he may be said to have inherited the taste from his father, who, although never having studied medicine systematically, had that turn of mind which is constantly tending to contemplate the nature of disease. A paternal aunt of Dr. Ryder studied medicine. She was never graduated. Her medical opinion was frequently sought for and valued in the community where she lived. She was also of an inventive turn of mind.

Dr. Ryder early exhibited a taste for natural history. When three years old he was constantly bringing into the house brightly colored stones, insects and other natural objects. At eight years he knew the botanical names of all the plants in his father's nursery. While very young he was noted for a habit which distinguished him throughout life, namely, of always having his mind occupied with something apart from the duties in hand; thus, while helping his father at pruning or grafting, he would recite aloud passages from a favorite author, a copy of which would be found in his pocket. On one occasion his father hearing hearty laughter asked him the cause of his mirth. The boy replied he wondered how Diogenes felt living in such a small place as a tub, and what fun he must have had searching for the honest man.

Every farmer in those days kept a few swarms of bees. While Mr. Ryder was not a professional apiculturist, he knew in common with his neighbors a good deal about the raising of bees. Ryder developed an interest and without being specially instructed became proficient in the care of bees, and throughout life often reverted to their habits for many points in the economy of insects.

At three years of age he began to receive instruction from his maternal grandmother from whom he early mastered the rudiments of German. He attributed his subsequent fluency in German (for he could speak it like a native) to this early impression. A little book entitled "Biblische Naturgeschichte für Kinder" bears his name on the cover with the date of 1860.

Ryder spent the life usual to a country boy. He possessed great energy of body and was fond of walking, rarely, if ever, using a horse to ride, although the stable was at his command. He attended the country school from the age of six or seven until his fifteenth year, when he ran away. Soon afterward he was sent to the Academy and then to the Normal School at Millersville from which he also ran away, and did not return home but lived the life of a tramp for some days before he was detected. He was severely punished for both these escapades. It appears that Ryder was always very sensitive and never associated with boys of his age in the sports customary to youth, but wandered about alone through the woods and meadows collecting insects and plants. He soon earned the nickname of "crazy John." In the end his father prudently interviewed the principal of the Academy and made special arrangements which enabled Ryder to live on more agreeable terms. But he was unhappy under restraint. Class work was distasteful to him and discipline of any kind resented. In order to secure his obedience it was sometimes necessary to give him directions adverse to those which it was intended for him to obey. Preferring to study in his own way, he spent the greater portion of his time in the library of one of the local literary societies. He read every book it contained. He was greatly influenced by Horace Mann's "Thoughts for a Young Man,"[2] a copy of which he procured. In 1875 in writing to his brother he said "be careful of this book, five dollars would not buy it, if I were unable to get another." In 1868 when in his sixteenth

[2] "A Few Thoughts for a Young Man: a Lecture delivered before the Boston Mercantile Library Association on its 29th Anniversary. By Horace Mann. Boston: Ticknor, Reed and Fields, 1850.

year, he wrote home asking for a microscope, books on natural history, chemical apparatus, etc. His restless spirit caused him to drop out of the school for good after a few months.

He taught school in the neighborhood of Loudon and afterward in the High School of the county for three years. He was quite successful and was much esteemed by all who were brought in contact with him.

We now find Ryder in his twenty-second year with the best equipment it was possible to secure for him in a rural district. His tastes were defined, and he at once made up his mind to devote himself to the study of science. This decision was quickened by the failure of his father in business, so that Ryder was thrown entirely upon his own resources. Of a proud disposition, he refused all assistance from his relatives, and learning that the Jessup Fund of the Academy of Natural Sciences of Philadelphia afforded assistance to young men who were desirous of devoting themselves to the study of natural history, he came to Philadelphia in the spring of 1874, and appealed to Mr. Thomas Meehan, an old friend of his father, for advice. Mr. Meehan states that Ryder visited him at his residence in Germantown. His funds were low, and to save money he had walked the entire distance, twelve miles, from Philadelphia. Mr. Meehan was interested in Ryder, who was, however, urged not to attempt to live on the small amount of five dollars a week permitted by the fund. But Ryder was not to be deterred. He felt confident that he could in some way manage, and accordingly, armed with a letter of introduction, he visited the Academy and made formal application. This was, at first, unsuccessful, but in the latter part of the year he was duly appointed. He remained in the Academy as a beneficiary of the Fund for six years.

Little is known of his private life during the greater part of this time. In 1879, Mr. J. S. Kingsley, now Professor of Biology in Tuft's College, Massachusetts, was his associate, and through him it is ascertained that Ryder lived on the top floor of No. 1113 Chestnut Street. His chamber and laboratory were one. Upper rooms in business blocks were then cheap, and food at moderate prices, offered for the use of employés of newspaper offices in the neighborhood, could be obtained day and night. The markets and restaurants of Philadelphia furnish plain, wholesome food at rates which compare favorably with those in any American city. Meals at fifteen cents each are important factors in solving a problem of

living on seventy cents a day. It was the custom of the proprietor of the restaurant frequented by Ryder to put aside for him the oyster shells, which, after each meal, were inspected for organisms. In this way he discovered the sponge *Camaraphysema*. Doubtless the work on the habits and food of the oyster, on which Ryder's fame in a measure rests, began in these desultory studies.

It was a time of formative plans. Among these may be recalled—an educational scheme by which the teachers in the public schools were to be prepared for imparting the elements of biology to their pupils; a course of popular lectures at the Wagner Institute; and a series of papers on natural history for a Philadelphia paper. None of these came to anything.

Such a life in a region of stores and warehouses is well enough during the week. The days and nights are separated by the changes in light—but not by changes in habit. But on Sunday the business part of a city is but little better than a desert. Ryder was in the habit of spending this day, when the season favored his so doing, in the suburban districts, or in Fairmount Park. It was on such excursions he discovered *Scolopendrella* and *Eurypauropus*.

The previous education of Ryder was one inadequately qualifying him for the career of a naturalist. This, indeed, is not less than that required to equip a student for any intellectual career whatsoever. How immense the labor when one is compelled to equip himself! The naturalist must be a linguist (for there is scarcely a modern European language which may not possess a treasure for his needs); he is all the better for being a draughtsman; he should command a good literary style; he should be a mathematician and physicist. Ryder, in these preparatory years, attempted all these things but the last. His endeavors to acquire new languages and a good literary style were unending. One of his favorite pastimes was to read an essay of Addison twice and then write out the essay from memory. He would then compare his sketch with the original. His tastes in art were not formed, and he rarely alluded to the subjects embraced among the humanities.

Mr. W. P. Seal, the well-known aquarium expert, was of great value to Ryder at this time in bringing him all the unusual specimens he detected while making collections of fresh water fishes and plants in the neighborhood of Philadelphia. At the end of his service in the Academy, Ryder had contributed thirty-one papers, most of which were based upon studies made in the Museum or on low forms of life.

In 1880, the National Government was desirous of having investigations prosecuted in behalf of the United States Fish Commission on the life-history of the American food-fishes and other aquatic animals, especially their embryology and growth, the character of their food in the early as well as the later stages of life. In the judgment of Prof. Baird, who was at that time Commissioner, no one in the country possessed the qualifications to meet the provisions of such investigations in so high a degree as Dr. Ryder.

He was at once invited to undertake the work, which not only gave him an opportunity of systematizing his studies (these were already embracing the higher problems in biology), but had the advantage of placing him in a better paid position.

It is true that up to this date Ryder had given no special attention to fishes, but he had obtained a general knowledge of the subject at the Academy, his inherited talent for invention lent itself readily to the details of field-work, while his acquaintance with the lower forms of aquatic life fitted him for the study of the food of fishes, the study of their young stages, their parasites, etc.[3]

Dr. Ryder always referred to this period with interest. His first detail was to the field, but in 1882, Prof. Baird transferred him to the National Museum, occasionally only, assigning him to field-work. He was extraordinarily active during the six years he remained on the Commission. He contributed twenty-nine papers on the oyster and oyster-culture, and fifty papers on the development of fishes, their food material and methods of development. All his contributions were carefully prepared and showed extensive knowledge of the subjects treated. He discovered, in 1888, a byssus in a young stage of the long clam *Mya arenaria*. Prof. Baird, in commenting on this discovery in his report for that year, believed "it to be of economic importance since the young individuals now can be freely handled and transported." Mr. Bashford Dean remarks: "I have heard it said that Dr. Ryder had, in his scientific work, grown up with the Commission; it might, I think, be said even as justly that the Commission had, in a measure, grown up with him."[4] His personality and methods had stamped themselves upon every

[3] (1) The following papers, prior to 1880, related to Dr. Ryder's contribution to ichthyology: "On the Origin of Bilateral Symmetry and the Numerous Segments of the Soft Rays of Fishes;" "Phosphorescence of very Young Fishes;" "The Psorosperms found in *Aphredoderus sayanus*."

[4] Memorial Pamphlet.

officer of the Commission to which he had been originally attached as an expert. He "merited the confidence and esteem of every one from the Commissioner to the humblest attendant."

On the occasion of his resignation, 1886, Prof. Baird expressed himself in a personal letter in these words: "In view of the many years of your connection with the Fish Commission, and the valuable services which you have rendered by the exercise of your professional skill and ability, I accept your resignation with very great regret.' His work, however, on the Commission, did not at once cease. He was employed in May and June, 1888, to investigate the sturgeon fisheries in the Delaware River.[5] During the remainder of the summer of the same year, he had charge of the station at Wood's Hole.

His interest in the study of Cetacea began while on the Commission. Although his work on this subject was never extensive, perhaps no other group of observations better illustrate the higher characteristics of his mind.

In 1886, it was determined by the authorities of the University of Pennsylvania, at the suggestion of Prof. Horace Jayne, to found a chair of Comparative Histology and Embryology. As stated by Prof. Jayne, "It was seen that a course was needed which would give students a thorough knowledge of comparative microscopic anatomy, together with the development of the tissues and of the different kinds of animal forms."[6] The chair was offered to Dr. Ryder and accepted, though "he hesitated at first," to again quote Prof. Jayne, "because he mistrusted his power to teach and handle large classes of students, a mistrust which was never shared by his friends." In many respects, the change from the duties of a biological expert on the Fish Commission to those of a professorial position was beneficial. He was now enabled to systematize his time, and permitted to extend the range of his inquiries. By renewal of associations at the Academy of Natural Sciences, he was assisted also in keeping thoroughly in touch with the progress of his favorite science.

In illustration of the zeal with which he prepared himself for his new duties, the following extract is taken from a letter written to Mr. Seal, from Chambersburg. "I am embracing an opportunity for the collection of embryos of warm-blooded vertebrates, which I

[5] Report of Fish Commission, Bulletin, 1888, p. 231.

[6] Memorial Pamphlet.

have never enjoyed until this season, and, unless one can give his whole time to the work of opening hundreds of females with great care, and have the means and time to preserve the material obtained, it is but very little use to bother with the subject. I have eviscerated about five hundred rats, mice, field-mice, moles, bats and musk-rats. I have a fine lot of embryos of all stages nicely preserved. Besides this I have obtained two hundred and fifty sparrow's eggs in all stages of incubation, which I have also put in good condition."

After an experience of nine years, terminating only in his death, it can be said of him that all the expectations raised at the time of his appointment were more than realized. He proved himself to be a diligent teacher and an esteemed colleague. As matters appear to be arranged for men of Ryder's attainments, a university position is the best available. Speaking for the personal side of his career, it may be said of him, as I am sure he might have said for himself, that to receive the respectful admiration and affection of pupils and to influence for good the mental development of youth, is for any man a sufficient reward. A former pupil, Mr. H. F. Moore, says of him: "What he may have lacked in some of the usual attributes of a successful teacher was more than compensated for by his keen sympathy, his painstaking care and his skill with crayon and pencil. If he had found a point of interest in his work, he usually invited us to enter, and would unfold to us his hopes and aspirations with the enthusiasm and simplicity of youth." Yet, after all is said, one must agree with his friend, Mr. W. V. McKean, that "Ryder was essentially the kind of investigator that it would have been a public benefit to have established in an amply endowed university chair, so that he might be entirely free to pursue his researches unhindered by any mere task work."

Dr. Ryder enjoyed perfect health until 1882, when he contracted malaria while engaged in some researches in connection with his work on the Fish Commission, at Ridge, Maryland. He suffered from a recurrence in 1888, while residing in Philadelphia. About this time dyspepsia announced itself. He suffered greatly and became much emaciated. In the summer of 1890 he visited Europe, but returned scarcely at all improved. He had an attack of the prevailing influenza in 1894, and from this time more serious and obscure impairment of the general health ensued. He died March 26, 1895, after an acute illness of a few days, aged forty-three years.

Dr. Ryder's death was unexpected, and expressions of regret were universal. The daily papers published detailed accounts of his life and services. Immediately after the death, the Board of Trustees of the University held a meeting, at which Dr. S. Weir Mitchell made a feeling announcement. The Board then passed the following resolution: "The Trustees of the University of Pennsylvania deplore the loss sustained by it in the death of John A. Ryder, Ph. D., Professor of Comparative Histology and Embryology. Called to that Chair in 1886, he quitted for it a congenial field of labor under the United States Fish Commission, in which he had rendered great service to the Government, and acquired for himself a world-wide reputation. Thenceforth, he devoted himself equally, and with a fidelity and effectiveness that ended only with his life, to the work of a teacher and that of an investigator. His characteristic traits were modesty, unselfishness, and sincerity in the search for truth. To these were added a rare talent for investigation, strong intellectual capacity, and unremitting industry; and these inured not only to the benefit of the school in which he taught, but to the distinct advancement, both in theory and in application to the science of biology to which his life was consecrated."

The funeral services were conducted by Prof. George F. Fullerton, Vice-Provost, and the Rev. Dr. H. C. McCook. His body was cremated.

A memorial meeting, held in the hall of the Academy of Natural Sciences of Philadelphia, April 10th, was participated in by members of the faculty of the University of Pennsylvania, representatives of the American Philosophical Society, the United States Fish Commission, and the Academy.[7]

Dr. Ryder was elected a member of the Academy of Natural Sciences of Philadelphia, January 29, 1878, and of the Biological Section of that body November 15, 1886. He was Director of the Section from 1886 to 1888. He was elected a member of the American Philosophical Society, December 17, 1886. The University of Pennsylvania conferred upon him the degree of Doctor of Philosophy, 1886. He was also a member of the following societies: The Zoological Society of Philadelphia (life member); the American Morphological Society; the American Society of Naturalists; the American Association for the Advancement of Science; the Association of American Anatomists, and the Historical Society of Pennsylvania.

[7] See note on page 222.

II.

Dr. Ryder was a man of restless mental activity. Plan after plan was discussed in his early letters. No defence was offered for this eagerness of spirit. On the contrary, he says in one of his outbursts: "I see more worlds ahead of me to conquer, so that I have little time to attend to number one, that often restive and troublesome person who is always reaching for toys he ought not to have, greatly to the disadvantage of more serious matters." Circumstances annulled most of his numerous enterprises, but the ideas were, without exception, admirable, and some of them were afterward realized by others. In 1879, he proposed to establish in Philadelphia, in conjunction with Mr. W. C. Seal, a depot of material for biological laboratories and class-room demonstrations. It was intended that Mr. Seal would collect and preserve the specimens which Dr. Ryder would undertake to identify and to furnish all other information. It was designed to embrace marine and fresh-water, as well as terrestrial forms. In association with his friend, Mr. J. S. Kingsley, he at one time thought of writing a book on the infusoria, a work that yet remains a desideratum. Dr. Ryder had a ready knowledge of the group. In later years he constantly reverted to it for illustration in his studies of the movements of protoplasm. A third undertaking on the embryology of fishes was proposed. It never went further than the title-page. In 1887, he seriously contemplated a text-book on general embryology. It was to be "copiously illustrated and to set forth the principles from new points of view." To this task he intended devoting two or three years. In 1893, he published, under the auspices of the University of Pennsylvania, a pamphlet entitled "The Synthetical Museum of Comparative Anatomy as the Basis for a Comprehensive System of Research."

It is a remarkable fact that Dr. Ryder, in his active and versatile career, never wrote an extended memoir. Everything he prepared for the press was the direct outcome of the practical tasks upon which he was officially engaged.

His work in zoology[8] was not large. Reference to the bibliography shows that twelve papers may be so classified. He once

[8] Dr. Ryder made a few observations in physiological botany. Early in his career, viz., 1877, he noted the disposition of the tendrils of *Cocculus indicus* to twine. (Proc. A. N. S., 1877, 3). In 1879 he observed the honey-glands of the leaves of *Catalpa*, and the habits of bees respecting them. (Proc. A. N. S., 1879, 6; Pastime, 1881, II, 8; Am. Nat., 1878, 4.)

said, "The species makers are caviare to me." But he himself did not escape the fate of most biologists in the making of species.

I have given my impressions of his disinclination to study species elsewhere :[9] "In competent hands the elucidation of species is not, as it has opprobriously been said to be, a dullard's task of taking an inventory of nature, but the study of the ultimate forms which those organisms assume which breed true. The shifting of color schemes, the exhibition of the effects of food and climate on size in whole or in parts, and of other causes by which minute differentiations are started and maintained, are of unending interest, and worthy of the best powers of the naturalist. If Ryder had been more closely identified than he was with the careers of the great academicians who had preceded him, it would in no whit have detracted from the value of his philosophical labors. One cannot but regret, if for no other reason than for his health's sake, that he discontinued those fruitful excursions to our woods, ponds and rivers, by which he contributed so notably to our micro-fauna."

While Dr. Ryder did not identify himself with zoology, his reputation may be said to rest in great part upon his labors on the morphology of the early stages of the development of fishes. This work, for the most part, represents that accomplished by him as an expert on the Fish Commission. His interest in the subject of the nature of species was, however, a deep-seated one, and he was constantly reviewing masses of data which he had accumulated in attempting to explain the tenets of evolution. That these attempts should have been largely in the direction of dynamics was to be expected, since he was enabled to apply to the problems his talent for mechanics and invention. He also had at hand the conclusions of many contemporaries who were with him eagerly seeking for a hypothesis of evolution not embraced in that of natural selection.

As early as 1874, he wrote: "I think I have discovered a law which offers a way to the solution of the variation of forms in animal life. This law I propose to call the law of the dynamics of phylogeny. In reading over Herbert Spencer's brilliant essay on the circulation of sap in plants and the formation of wood, I saw the solution of the problem. Here is field enough for a Darwin. I almost shrink from the task when I consider its magnitude. Cleavage of muscular fibre; the processes of bone; the arrangement of the bony layers; the change of form and length and of position of bony pro-

[9] Memorial Pamphlet.

cesses; their relations as a whole; their relations to the muscles; their form, arrangements, etc., all proclaim a common law: while every abnormality, injury, reparative expedient, still further strengthens it in my mind, and is the only thing that will demonstrate to the world the truths of the doctrines of unity of law and universal evolution. It completes Darwin's work on a grander scale than Darwin ever dreamed of. It still further declares that there is one eternal ever-active cause, operating in lines of constant and mathematical precision. If Dr. Haughton, of Cambridge, can demonstrate the mathematics of the bones and muscles, surely some one else can study the dynamics that creates them."

His first work in speculative biology was an attempt to explain by such reasoning a law of reduction of digits in the mammalia.[10] In the same year he endeavored to establish a dynamical theory to account for the modifications in the forms of tooth structure and to correlate this structure with the shapes of the lower jaw and other parts of the skull. In the following year he discussed the mechanical genesis, degeneration and coalescence of vertebral centra in a gigantic extinct armadillo.

He developed a theory on the origin of the amnion in 1886, and his explanation of the different types of placentæ in 1887. In 1889 he defended the thesis "that the segmentation of the soft rays of the fins of fishes are simply fractures due to flexures, and that on the caudal fin they possess probably the same direction as the intermyomeric fissures."[11] Ryder's bibliography contains fourteen titles of papers which illustrate similar lines of reasoning.

In the same year we have evidence of additions to his methods, for, while keeping to the lines already indicated, he added others of a different character, and sustained by broadly contrasted methods of expression. Allusion is made especially to his studies of the contractility of protoplasm, which is first mentioned in his paper, "On the Fore and Aft Poles, the Axial Differentiation and a Possible Anterior Sensory Apparatus of *Volvox minor*" and in his paper on the "Origin and Meaning of Sex." These papers began a series which (included in the bibliography under numbers 174, 186, 190 and 191) dealt not so much with problems in dynamics as with the old vital doctrines, or, as would be expressed in modern phrase, metabolism. "The Origin and Meaning of Sex" appeared in the *Biological Bul-*

[10] Law of Digital Reduction, Proc. A. N. S., 1877.

[11] E. D. Cope, Memorial Pamphlet.

letin, Univ. of Penna., 1889. Extensions of opinion were printed in the *Proceedings* of the Academy, 1889, and in the *American Naturalist*, 1889, 501. He held that over-nutrition led to all forms of sexual reproduction; that the male and female elements are contrasted in their tendency to undergo segmentation—the female element having lost the power to undergo such segmentation spontaneously (excepting in parthenogenesis),—while the male element is accompanied by an increase of segmental power, * * * * "Sex probably arose simultaneously and independently in both female and male as soon as certain cells of coherent groups became over nourished, and incapable of further segmentation unless brought into contact and fused with the minute male element, or one which is the product of an increase of segmentational power which is transferred to the female element in the act of fertilization." Important applications were made of the hypothesis to the study of variation, the evolution of sexual characters, and, as the author believed, a consistent and simple theory of inheritance which is in harmony with all the facts of reproduction. At this time he was in a state bordering on exaltation. "I sat up late last night after the whole thing flashed across my mind in an instant," he writes, "and did not sleep for two hours after I went to bed because my brain was going like a dynamo, thinking out detail after detail of my hypothesis. * * * * Wolfe and Schwann mark two eras in the history of hypothesis. I shall mark a third if I live to complete the sketch of the vast hypothesis. * * * * My disappointments vanish into the uttermost inane when I think of what it has been possible for me to achieve."

After such strong evidence of his belief in the value of this theory, it is hard to understand how he practically dropped the subject. Subsequent to the dates above given, I have come across no reference to it, nor is any mention made of the matter in the estimates of his work that have appeared since his death.

It is impossible to understand Ryder's attitude toward evolution, without regarding his disbelief in the "cult" usually known as Weismannism, which embraces the opinions that acquired characters cannot be transmitted, and that a portion of each organism is carried unchanged from parent to offspring. He said, in his paper on sex, "The hypothesis which assumes that the germ-plasma is precociously set aside in order to render it unmiscible with the somatic plasma, and therefore immortal, is based upon a fundamental error

of interpretation of the facts of morphology." In another place, an address entitled "Dynamics in Evolution," 1893, he said, "experimental investigations in embryology will make no solid progress until the mischievous influence of such speculations have been eradicated from the minds of the present generation." These opinions remained unmodified to the day of his death. Perhaps the best expression of his views can be found in a lecture delivered at Wood's Hole, 1894, and a second lecture entitled "A Dynamical Hypothesis of Inheritance."

The last phase of his scientific life is the most instructive, namely, that relating to the application of geometry and the differential calculus to the study of organic forms. The idea that anatomy and mathematics can be of mutual assistance generally comes to savants too late for practical use. Against the example of Helmholtz we cite many failures. Mathematics came to John Goodsir too late for anatomy, and anatomy to Fechner too late for mathematics. When Ryder saw the necessity of preparing himself in these sciences (for his early training had excluded them), he set to work to supply the defect with characteristic energy. He studied geometry and the calculus in spare hours. He became enthusiastic for them. He declared geometry to be the noblest of the sciences. He read the writings of Lord Kelvin carefully; his admiration for them was unbounded. At the time of Ryder's death, two works lay on the bed, one was a text-book on the differential calculus, the other a volume of Lord Kelvin's works.

It is difficult to fix a time when the mathematical explanation of the mechanics of evolution occurred to him. We have seen that he was influenced by Haughton as early as 1874. If we can draw an inference from the reading of the paper entitled "The Fore and Aft Poles of *Volvox minor*," previously quoted, and again the essay "The Polar Differentiation of *Volvox minor*" and "Specialization of Possible Anterior Sense Organs" (No. 174, Bibliography), the idea apparently suggested itself by studies in the early Academy days on the infusoria and later on the development of simple organisms. The same conception occurs in his papers on "Energy in Biological Evolution;" "Of the Representation of the Relative Intensity of the Conflict Between Organisms;" "Energy as a Factor in Organic Evolution;" "Mechanical Genesis of the Form of the Fowl's Egg;" "The Adaptive Forms and Vortex Motions of the Substance of the Red Blood Corpuscles of Vertebrates;" "The Correlation of the

Volumes and Surfaces of Organisms."[12] One of the last demonstrations he made was at a meeting of the Bibliographical Club of the University of Pennsylvania, when he exhibited contractile films of gelatin in illustration of the mechanical conditions underlying the problem of the arrangement of the convolutions of the brain.

In January, 1890, he writes: "It is my hope to reduce the doctrine of evolution into a simple realization of Newtonian principles. The three great Newtonian laws of motion are at the bottom of the whole matter. Some day I shall be able to tell a great deal that I have kept to myself in order to test its truth. * * * * I am engaged—and will be hereafter almost entirely—in determining the factors and processes which have effected the evolution and divergence of species. * * * * I have at last worked out a new theory of inheritance which must ultimately replace those of Weismann and Darwin, or at least furnish the foundation by which the data and phenomena of variation and inheritance can be co-ordinated with the great universal principle of the doctrine of the conservation of energy. The speculations of Darwin, Haeckel, Weismann, Brooks, DeBries, Strassburger and Nageli looking to a theory of inheritance are irreconcilable with the fundamental postulates of physical science, and must be abandoned. This also renders the conflict between the hypothesis of Darwin and those of Lamarck one of primary importance, and sharply defines the line of battle between the thinkers who range themselves under the banner of one or the other of these prophets of transformism."

While it is impossible to say what Dr. Ryder would have accomplished in his attempt to use mathematics as a medium of expression of biological problems, this much can be said, not only for him, but for all others similarly placed, that a course of training in geometry and the higher mathematics should be a part of the equipment of the student in biology. It does, indeed, seem pitiable that, ascending the heights of knowledge, he finds, as he nears the top, that the key which he believes can alone open the temple erected there has been left behind.

III.

Dr. Ryder was five feet eleven inches high, of a slender, slightly-stooping figure. While spare he had a robust physique. He was

[12] See Bibliography, Nos. 182, 184, 186, 187, 189, and especially Nos. 190, 191, 192, 195, 199, 200, 204, 205, 206 and 207.

of nervous temperament. His complexion was light—the hair flaxen. He was plain—almost careless—in his dress. He had a habit of sitting cross-legged and swinging one foot when deeply engaged in thought or study. He was of a genial disposition and enjoyed gatherings with his students after class hours, or discussions with his colleagues and friends at the Academy and other places. His learning was great, especially in contemporary literature, and nothing appeared to give him so much pleasure as talking of the work of his co-laborers; but he disliked what are called "social functions," and toward the latter part of his life was rarely present at them. From the beginning of his scientific career to his later years he did not require much sleep, taking about six hours daily, though his habits in this respect were never regular. He had great energy of mind, and power of accomplishing a large amount of brain work. His memory was remarkably retentive—he never forgot anything he once heard or read. In addition to his early attainment of German, he read for scientific purposes French, Italian, Spanish, Dutch, Danish, Swedish and Russian.

His sense of duty was highly developed. He believed that the power of the will over action was practically without limit. Yet the motive for the exercise of the will must be from within. Hence can be explained his apparent obstinacy of disposition as a child; his aversion to class work at school; and his independence of convention, both as to thought and action in mature life.

Sometime prior to his appointment on the Fish Commission, Mr. W. V. McKean invited him to write articles on natural history for the *Public Ledger*. But Ryder could not overcome a distrust that his essays would be too technical for popular favor. That he should have declined an offer apparently so advantageous to himself at a time when he needed money, is an evidence of the rigid scrutiny to which he subjected all his actions. None but his most intimate friends knew of the costs he often paid to maintain his freedom of mental action. They were met without a murmur. But in their payment he doubtless drew largely on that vital energy, without which long life is impossible. His dearest friend said of him, "his self-sacrificing devotion cost him his life."

But, under the stern repression lay a child-like, affectionate nature. He was not happy unless he had one or more of his family with him; he was continually writing to the absent ones. His domestic letters contain full accounts of how he lived, whom he met,

and of his enthusiasm for his discoveries. Those who knew him only as a scientist, had but little conception of the spirit that actuated him. His work was not a series of merely intellectual achievements, but back of it all lay the feeling that he was bringing something bright and interesting from the outside world to adorn the home.

His affection for kin extended to his friends. His relations with Prof. Baird were almost those of a son. His anxiety and distress at Prof. Baird's last illness found expression in all the letters he wrote at that time. As is common with such natures, his sense of justice was keen, though no instance can be shown in which his indignation was not excited by the general sense of wrong implied in the situation rather than by any personal feeling.

Dr. Ryder's religious training was that of the strict orthodox Christian faith as expressed in the teachings of the Mennonites. His paternal grandmother who directed his education was a woman of deep piety. For the faith of his parents he always entertained the profoundest respect, and at least toward the latter part of his life was inclined to return to it. At the age of eighteen he studied the Bible closely; and, ever afterward, no matter how limited his travelling effects, a copy of the New Testament was always among them. Though, as shown by his letters, he departed from the tenets of his early education, one cannot doubt that he retained all the force of a severe mental and moral discipline that such teaching implies. He was faithful in friendship; singularly frank and sincere in disposition; and disliked violent language, dispute or criticism. He was always severe to himself, but sacrificing in spirit to those whom he loved.

While a Jessup Fund student he became a devoted listener to the Rev. Mr. Mangasarian, an Armenian preacher, who, at that time, held a pulpit in a Presbyterian church in Philadelphia, but who afterward became a leader in an independent organization allied to the Society of Ethical Culture. In speaking of Mangasarian in one of his letters, Dr. Ryder uses the following language: "He has all the charm of the finished orator combined with rationalism and advanced evolution." Ryder greatly admired Emerson. He spoke of him as "the sanest man of the nineteenth century." In writing to a friend who was in mental distress, he advised him to read Emerson. He carried his admiration even to matters of scientific import. In his last paper he quotes from this writer the saying: "To a sound judgment the most abstract truth is the most practical." He

was much influenced by the teachings of the Stoics. "I would strongly advise you," said he to a friend, "to get hold of the thoughts of Marcus Aurelius, when you are most provoked or vexed in spirit, and take their lessons to heart. Epictetus will do equally well, only I think Marcus is calculated to humble and content a man." His letters contain many expressions of trust in an infinite beneficence, and he would have agreed with Epictetus as to "whither dost thou tend after death, that is to nothing dreadful, but to a place from whence thou camest, to things friendly and akin to thee."

We admire Ryder not so much for what he accomplished as for the indomitable spirit that actuated him. With imperfect equipment, with engrossing occupation, and—for much of his intellectual life at least—with impaired health, he attempted the solution of the most difficult problems. It is not for us to consider in what degree he succeeded. Had Bacon, Franklin or Darwin died at forty-three, or had their days been absorbed as his had been, in cares and the routine of task work, how much less would have been their achievments! It is enough for us to know that we are studying in Ryder's life phenomena of a mind of the first order, and that we have lost by his death one of the brightest of the group of workers to which he belonged.

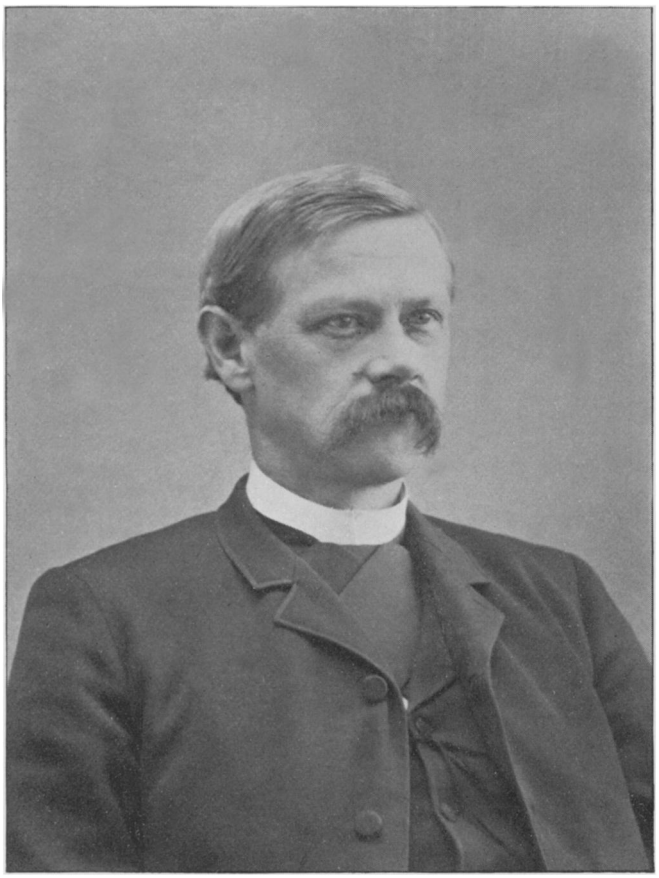
THE PUBLISHED SCIENTIFIC PAPERS OF JOHN A. RYDER.

BY H. F. MOORE, PH. D.

This bibliography was originally prepared for the Proceedings of the Ryder Memorial Meeting but the committee having that publication in charge pointed out that the importance of Dr. Ryder's work demanded for it greater publicity than that medium would afford. It was suggested that it would be most fitting to publish it with the preceding memoir.

The list of papers given is supposed to be complete, being prepared partly from memoranda left by Dr. Ryder and partly by research in the bibliographies of the *Zoological Record* and of the several journals as well as in the sources of original publication.

The citations, with one or two exceptions, have been verified, and the appended notes are partly from the *Zoological Record,* partly Dr. Ryder's and partly by the compiler. The list is given under three heads: Original Research, comprising 215 titles; Descriptions of New Scientific Apparatus, 4 titles; and Translations and Reviews, 59 titles; a grand total of 278 papers published between 1877 and 1895.



John A. Ryder